



# Army PM UAS Spectrum Update

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**PACOM 2012**

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# Army Unmanned Aircraft Systems

## Corps Level

Corps Level reconnaissance, surveillance, target acquisition, and battle damage assessment

## Division Level

Provide dedicated mission configured, UAV support to the Combat Aviation Brigade, Division Fires and Battlefield Surveillance Brigades, Brigade Combat Teams (BCTs), and other Army and Joint Force units based upon Division Commander's priorities

## Brigade Level

Provide Army Brigade Commanders with tactical level reconnaissance, surveillance, target acquisition, and battle damage assessment

## Battalion Level

Provides the small unit the organic capability to perform Beyond Visual Line-Of-Sight (BLOS) Reconnaissance, Surveillance, and Target Acquisition (RSTA)

### FOCUS OF ARMY UAS:

- ~~Strategic~~
- Operational
- Tactical

### Hunter

MQ-5B



### Gray Eagle

MQ-1C



### Shadow

RQ-7B



### Raven

RQ-11B

### Puma

RQ-20A



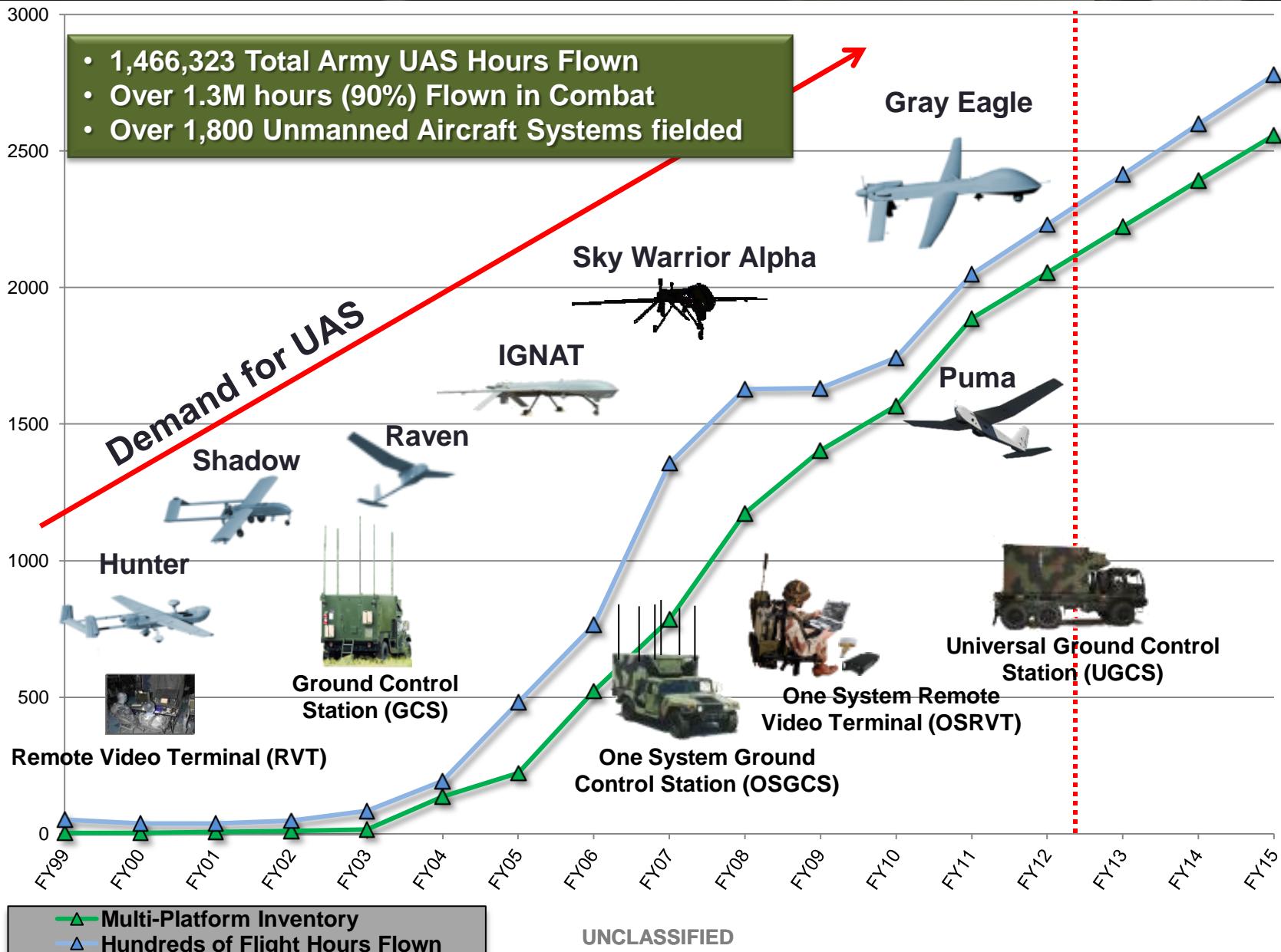
### Universal Ground Control Station

### One System Remote Video Terminal



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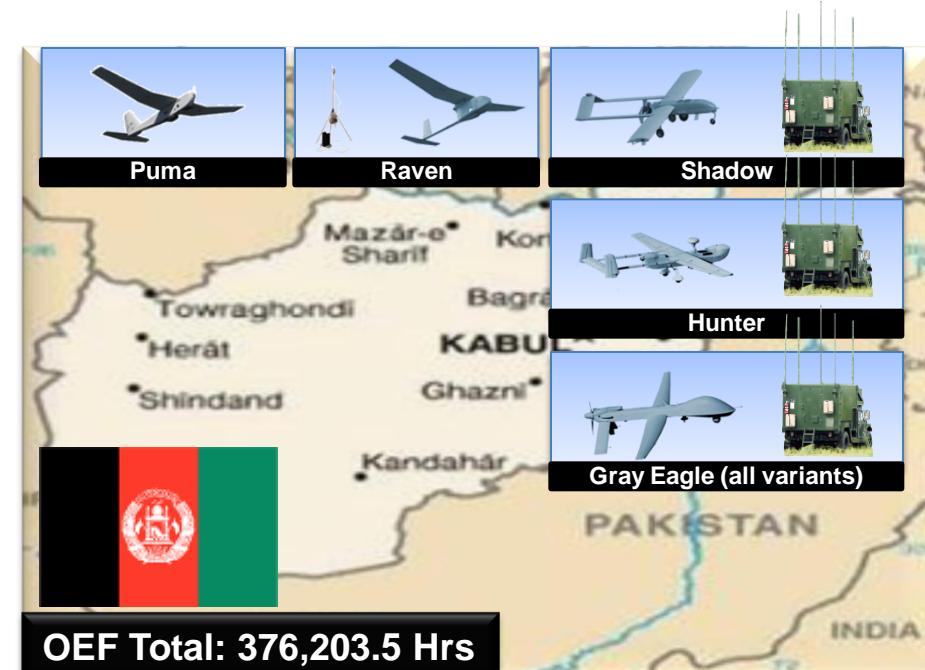
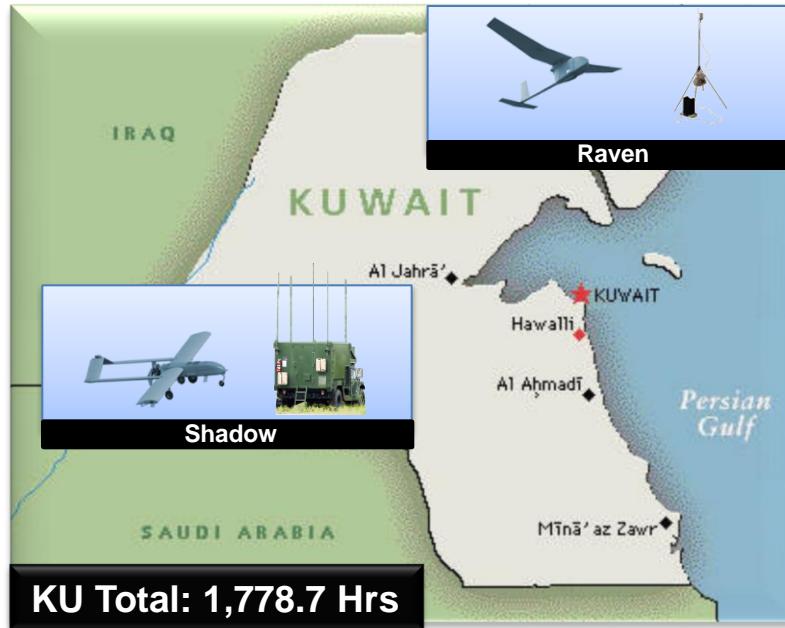
# Army UAS Demand





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# Supporting the Soldier Current Systems



Total UAS OIF/OND Hours (EOM 15 Dec 2012)

**991,966.7**

**Field Support Representatives in Country**

**Total Hours Flown : 1,526,064.6 Hrs**

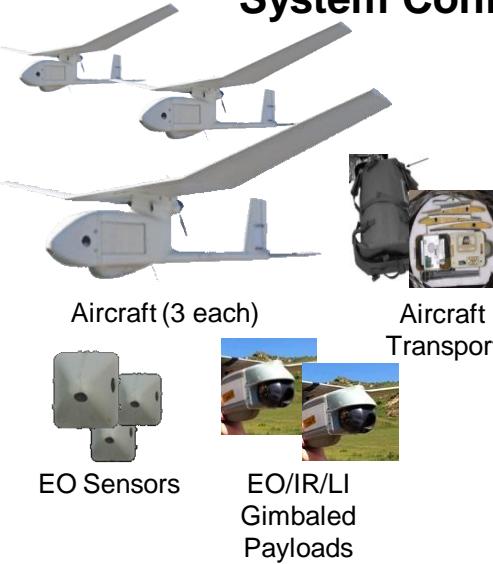
**OND/KU/OEF Hours Flown: 1,368,909.3 Hrs**

**90%  
Combat Hours  
Flown**



# System Overview: RQ-11B Raven

## System Configuration



## Characteristics/Description

Wing Span	4.6 ft
Air Vehicle Weight	4.4 lbs
Range	10+ km
Airspeed	27-60 mph
Altitude	>300 AGL
Endurance	90 min Lithium
Data Link	Digital Data Link; AES-128 encryption
Payload	<p>Current fixed sensors:</p> <ul style="list-style-type: none"><li>Electro-optical day camera (side and front: 2592x1944 pixels); 3X Zoom; 5 Megapixel</li><li>IR (320x240) with Laser Illuminator (25 ft IR spot marking capability)</li></ul> <p>Combined EO/IR/LI gimbaled sensors:</p> <ul style="list-style-type: none"><li>Electro-optical day camera (5MP-2592x1944 pixels); IR (640 x 480); Laser Illuminator</li></ul>
GCS	- 14 lbs (with RSTA laptop)

## Purpose

Provides the small unit with an increased situational awareness and force protection by providing expanded reconnaissance and surveillance coverage of maneuver areas.

## Characteristics

- Rapidly deployed/hand-launched
- SAASM GPS
- Semi-autonomous operations and tele-operations
- In-flight re-tasking
- Commanded auto-loiter at sensor point of interest
- Executes lost link recovery procedures
- Flight termination to pre-planned point
- Decentralized planning and execution
- Common mission planning (AMPS/Falcon View)

## Status

- RQ-11B; ACAT III POR – MDA is MG Crosby
- Production buyout of 2358 systems (FY15)
- Raven Surge on schedule
- Gimbaled Payload production begins 3QFY12
- All DDL retrofit kits procured
- Working CPD actions with TCM

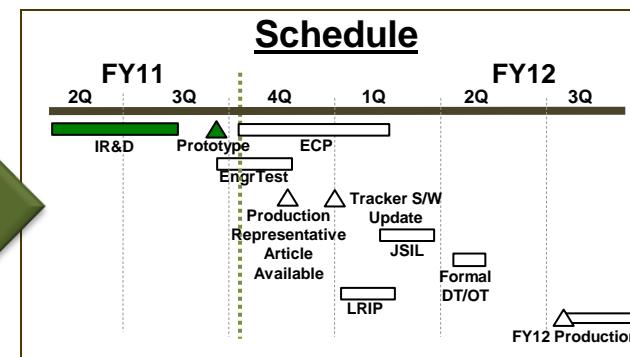


# RAVEN Gimbaled Payload

- Response to user requests
- Fits standard DDL Raven with S/W upgrade
- Full gimbal; stow on landing; ruggedized for nose impact
- Sized to accommodate other camera options such as SWIR
- Combined EO/IR/LI Sensors
  - 5MP EO (Same as Puma)
  - 640 x 480 IR (Same as Puma)
  - Laser Illuminator (Same as Raven)
- 3Q FY11 prototyping
- 3Q FY12 production



- Prototypes undergoing flight and qualification testing
- Low rate production planned Fall 2011
- Priority to OEF units



**Latest Technology into the Fight**





# System Overview: RQ-20A Puma AECV



## Characteristics/Description

Wing Span	9.16 ft
Air Vehicle Weight	12.9 lbs (with payload)
Range	10KM (Omni); 20KM (Patch Antenna)
Airspeed	23-41 mph
Altitude	>500 AGL
Endurance	120 minutes
Data Link	Digital Data Link; AES-128 encryption
Payload	<ul style="list-style-type: none"><li>- InfiniSpin (Dual mounted/fully gimbaled)</li><li>- Electro-optical day camera (side and front: 2592x1944 pixels); 3X Zoom; 5 Megapixel</li><li>- IR (640 x 480) with Laser Illuminator (25 ft IR spot marking capability)</li></ul>
GCS	<ul style="list-style-type: none"><li>- 14 lbs (with RSTA laptop)</li></ul>

## Purpose

Provides the small unit with an increased situational awareness and force protection by providing expanded reconnaissance and surveillance coverage of maneuver areas.

## Characteristics

- Rapidly deployed/hand-launched
- SAASM GPS
- Combined EO/IR/LI fully gimbaled payload
- Target tracking
- Follow-me mode for mobile operations
- In-flight re-tasking
- Executes lost link recovery procedures
- Flight termination to pre-planned point
- Common mission planning (AMPS/Falcon View)

## Status

- Non-POR
- Procured under 2 JUONS—288 total systems (includes systems inherited from REF)
- Uses same controller as Raven
- All systems for theater use and training



# Spectrum



## J/F-12 09670 (check HNSWDO)

- **M1- 1625-1725 MHz DDVL 4M68G7W or 1M56G7W**
- **M2- 1755-1850 MHz DDVL 30 FPS or 15 FPS**

## J/F-12 07160

- **216-216.1 MHz Falcon Tracking/Recovery system  
10K0P0N**

## J/F-12-TBD

- **1090 MHz TICK—No interrogation-periodic transmit**



# Spectrum Reallocation

## Losing the Lower 25 MHz of the band

- **RAVEN—PUMA— WASP--ACTS**
  - Can we find a way to compress operations in 5 years, prior to relocating to 2025-2110 MHz in 10 years?
  - If asked to vacate the lower 25 MHz indefinitely:
    - Can operations be compressed into the upper 70 MHz?
- Other 1755 – 1850 MHz Band systems
  - Can the other system operations be compressed?
  - What combinations of compressed operations can coexist in the upper 70 MHz indefinitely?
  - What combinations of compression and relocation are necessary to vacate the lower 25 MHz?



# Spectrum Reallocation Issues

## Primary concerns: Deconfliction

## Small Unmanned Aircraft Systems vs. Air Combat Telemetry Systems

## **SUAS- 2 Watts**      **vs.**      **ACTS 100 Watts**

## SUAS- 25 km normal radius    vs.    ACTS 200 km normal radius

## Primary Concerns: Operational

## Small Unmanned Aircraft Systems- normally 10 channels for close use

## IF we lose the lower 25 MHz

- 1) loss of 3 usable channels
- 2) loss of more channels due to other systems who have to share spectrum, ie; National Training Center's GSM system
- 3) Operational Impact: UNKNOWN- Mission Dependant



# Spectrum Reallocation: When?

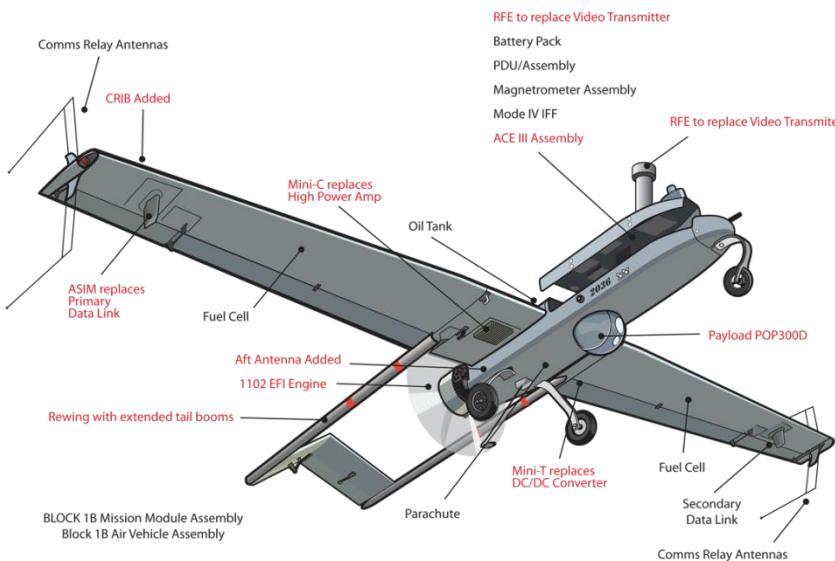
- **Spectrum Re-allocation for M1755-M1850 Status**

Commerce Department officials said they wouldn't make a formal recommendation to the FCC about auctioning the airwaves to wireless carriers until government and industry users reach some sort of agreement on how to share the airwaves.

(as of 3/30/2012)



# System Overview: RQ-7B Shadow®



## Quantity/Cost

- Manufacturer:** AAI Corporation, Hunt Valley, MD
- ACAT II** Program that is now conducting sustainment/upgrades
- APO:** 102 (All systems have been procured; currently fielding system 98)
- AAO:** 115; There is one Shadow Platoon per BCT, and one in 8 Special Forces Groups; BfSBs and Fires Brigades are not resourced

## Capabilities

- System consists of **four Air Vehicles, two Ground Control Stations, one rail launcher, and 8 HMMWVs**
- 9 hour endurance**
- EO/IR Laser Designator Payload (**Full Motion Video**)
- Capable of launch and land in remote locations (“soccer field”)
- SINCGARS Communications Relay
- 38 HP, 38 pound engine
- 18,000 ft MSL ceiling (supports operations in **Afghanistan Mountains**)
- Type 1 **Encryption** - Tactical Common Data Link

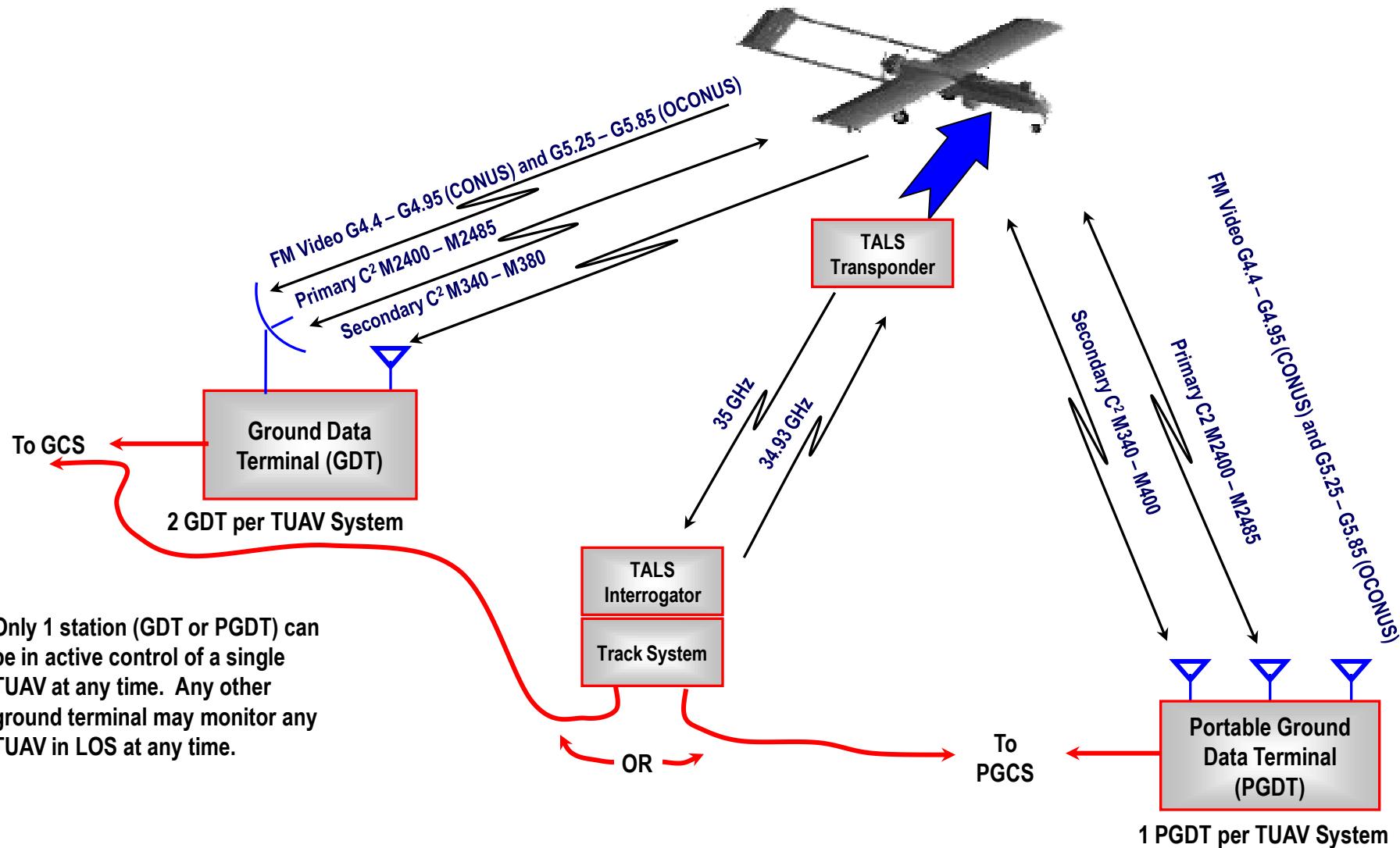
## Current Distribution of Systems (102)

Organization	Systems
Army BCTs	74 (46, 28)
SFGs	8 (6, 2)
GOCO	5 (1 Tng)
Training/Other	9 (+2 NGB Trng)
TCDL, FS CAB, TAFT, Aust	2, 2, 1, 1
Marine Corps, FMS	13, 2



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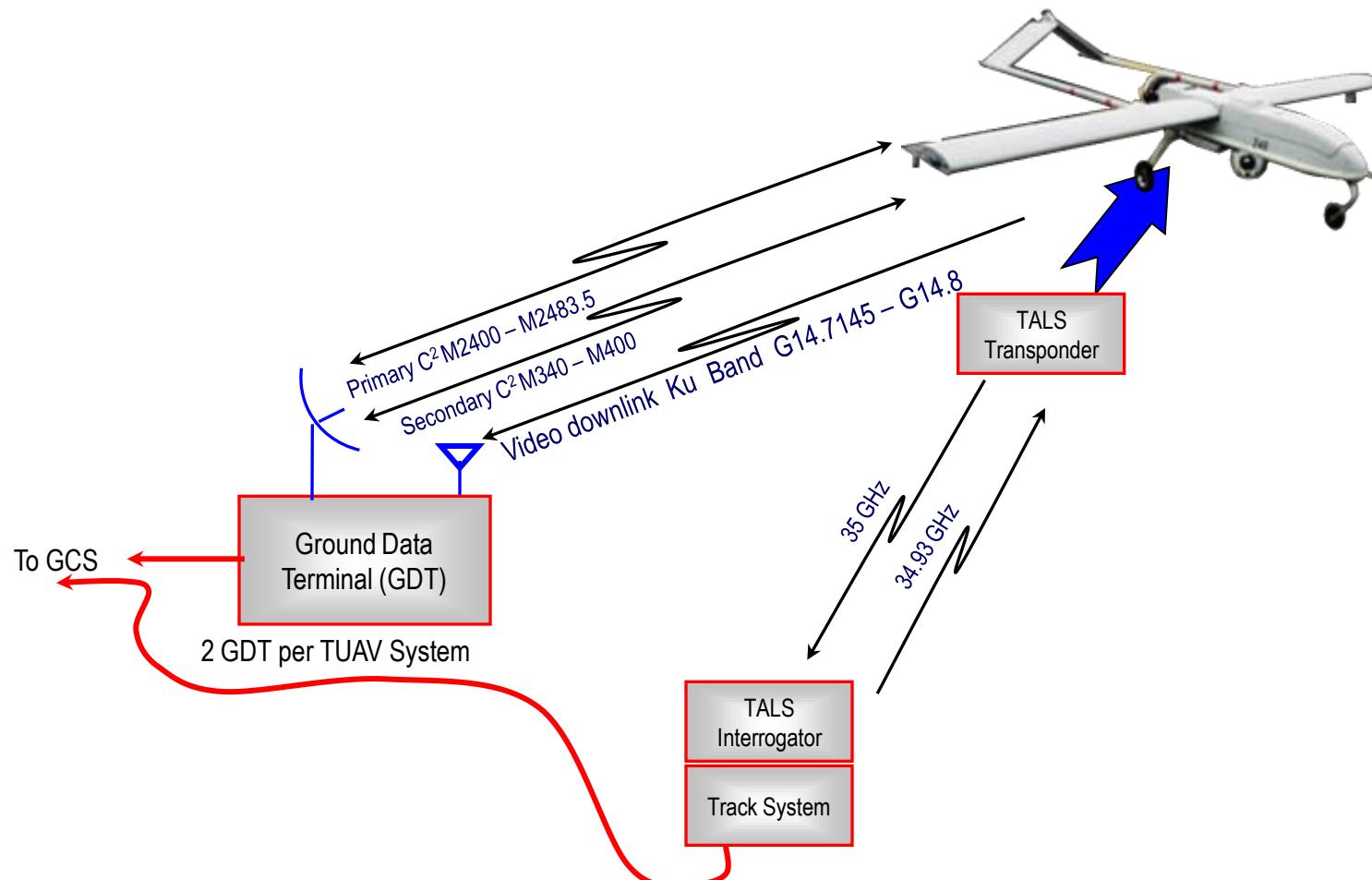
# C Band



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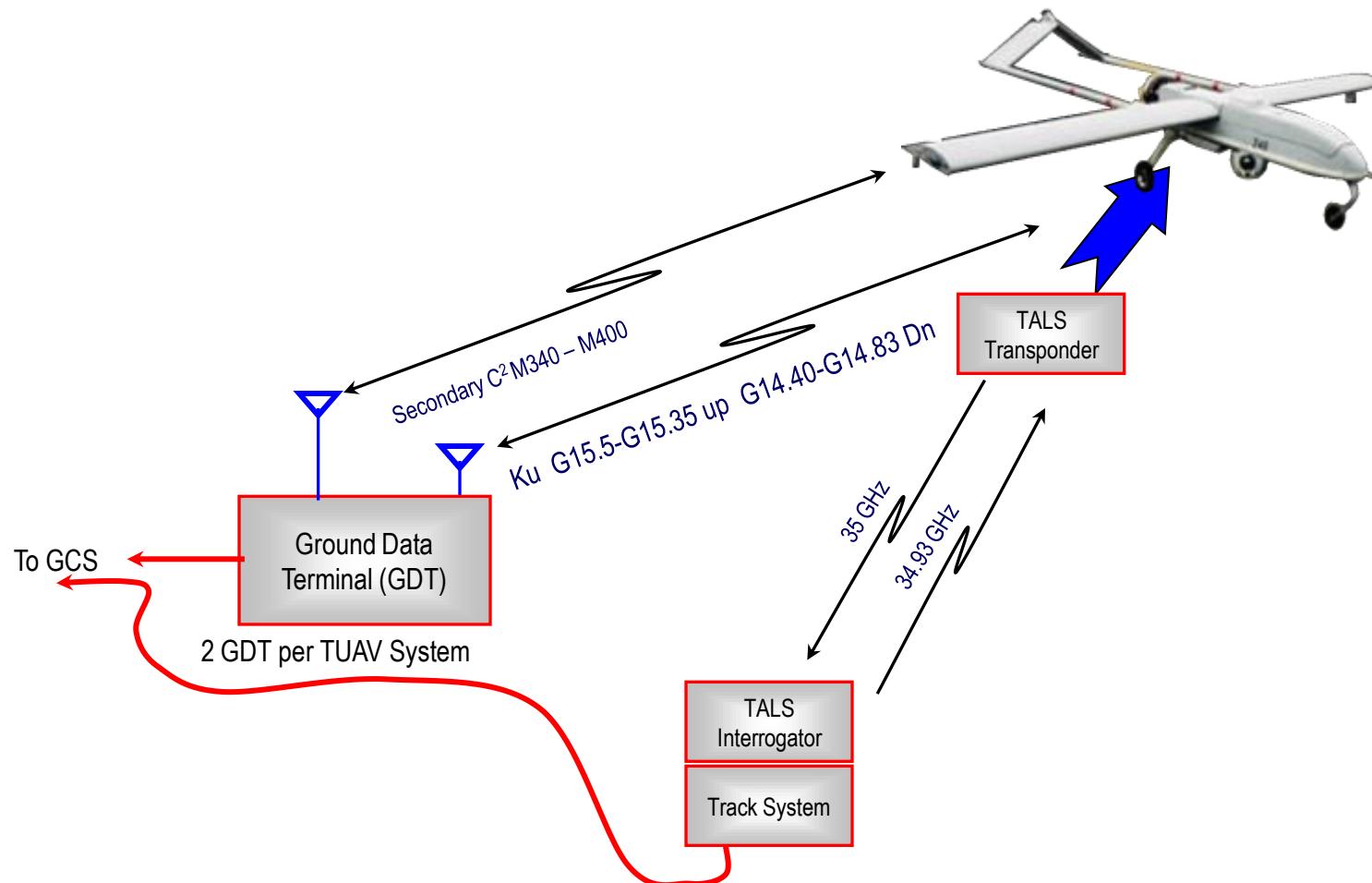
# Tactical Interim Encryption System





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# Tactical Common Data Link



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# Differences of Legacy & TCDL

## Legacy (or pre-TCDL) Shadow

Redundant C2 links, 52 bytes @16 Hz

Primary link = 2.40 to 2.48 GHz

Secondary Link = 340 to 400 MHz

Video, ~ Analog RS-170

CONUS = 4.90 to 4.95 GHz

OCONUS = 5.25 to 5.85 GHz

## TCDL

Combines primary C2 & payload into one link

Ku Band

10.7 Mbps waveform (10.5 down, .2 up)

BE CDL (4.0 Mbps, 4.0 down, .5 up)

2.0 Mbps (2.0 down, .2 up)

Keeps UHF secondary link



# System Overview: MQ-5B Hunter

## Mission

Unmanned Aircraft System providing 24/7 SIGINT, Intelligence, Surveillance and Reconnaissance to the three Aerial Exploitation Battalions (AEB). Command and Control Via OSGCS and C-Band or TCDL.



## History/Present

- Only UAS fielded at the AEBs (CORPS level).
- Peacetime Operations Based OMA
  - 4 systems fielded (1<sup>st</sup> MI, 224<sup>th</sup>, A15th MI, UASTB)
  - MTOE of 5 aircraft, Soldiers and 5 embedded CLS
  - Interoperability
  - Peacetime sustainment to include Depot, supply support, storage, engineering, spares, CLS, CM, Product Assurance and Program Management
- Valid Requirement – Directed Requirement
- Current direction is to keep Hunter operational until 2022

## Characteristics/Description

Wing Span	34.25 Ft
Max GTOW	1950 Lbs
Range	200Km LOS
Airspeed	62kts cruise/ 110 kts dash
Altitude	18,000 Ft DA
Operational Endurance	20 Hours payload dependent
Weapon	Equipped with Hardpoints
Launch/Recovery	Unapproved runway 1600 ft
Propulsion	HFE

## Fleet Status

- 14 supporting OEF
- 3 Schoolhouse (Ft. Huachuca) UASTB
- 6 Supporting Capability Base Rotation
- 2 Supporting engineering and safety of flight testing
- 8 In Reset and in various stages of repair/acceptance
- 12 TCDL aircraft in various stages of acceptance/production
- Utilizes the OSGCS and transitioning to UGCS
- C-Band and TCDL Datalink



# HUNTER Frequencies

- **Legacy C band. J/F-12 06601**  
14 preset Primary/6 Backup selectable frequency sets- 1 uplink+1 backup+1 OSRVT(downlink only)
- **Tactical Common Data Link(TCDL) Ku Band.**  
**1 Primary Link**  
**1 Backup Link**  
**1 Link-One System Remote Video Terminals(OSRVT)**



# System Overview: MQ-1C Gray Eagle

**Mission:** Provides the Division Commander a responsive, agile, and flexible capability to perform RSTA, Communications Relay, Manned-Unmanned Teaming and Target Attack Capability



## Mission Requirements

- Deployed and integrated with the Combat Aviation Brigade (CAB)
- Immediately responsive RSTA to the Division Commander
- Two simultaneous payloads (EO/IR, Laser Designator, SAR, Communications Relay) and weapons
- “Always on” Medium Communications Relay (SINCGARS, ELPRS)
- Tactical Common Data Link (TCDL) & SATCOM Communications
- Heavy Fuel Engine

## Characteristics/Description

Wing Span	56 Ft 3 in
Max GTOW	3,600 lbs
Range with Relay/SATCOM	>500/1200 km
Max Airspeed	150 kts
Altitude	>25,000 Ft
Endurance	Up to 24 hours
Weapon	Up to 4 HELLFIRE Missiles
Runway (Improved Surface)	4,500 ft max length required

## Company Set of Equipment

- 12 Multi-Purpose Aircraft (6 w/SATCOM)
- 6 Ground Control Stations
- 3 Portable Ground Control Stations
- 6 Tactical Common Data Link (TCDL) Ground Data Terminals
- 2 TCDL Portable Ground Data Terminals
- 3 Ground SATCOM system
- 6 Automatic Takeoff and Landing Systems
- Payloads
  - Electro Optic/Infrared (EO/IR)
  - Synthetic Aperture Radar's (SAR) / Ground Moving Target Indicator (GMTI)
  - SIGINT
  - WIN-T Communications Payload (WCP)
- Ground Support Equipment



# Gray Eagle System Characteristics

Company Equip Set  
(3 Balanced Platoons)



12 Unmanned Aircraft



6 Control Stations



9 TCDL GDT



3 Portable GCS



3 SATCOM GDT



6 TALS

Transition plan to  
Ka SATCOM

## Datalinks SATCOM & TCDL

- Ku Band SATCOM with migration to Ka Band NLT FY13
- Increased LOS datalink range over legacy C-band
- Increased bandwidth: TCDL 274 mbs/SATCOM 50 mbs



30" SATCOM TCDL Antennas

Transition plan  
to JTRS

## Standard Equipment Package

### Comms Relay Package-Medium

- Single Channel Comms Relay
- Secure Digital Communications



SINCGARS (x2)



APX-118 IFF ARC-231

Transition plan for  
WIN-T & SIGINT

## Payloads

EO/IR/LD	SAR/GMTI
HD/TLA	
SIGINT	WIN-T/JTRS

*The System is much  
more than just an  
Aircraft*

## Additional Capabilities

- Airframe
  - 3,600 lb GTOW with 2.0l engine
  - Designed for take-off and landing distance of 4,500 feet
- Near all weather capability
  - Wing De-icing capability allows flight through light icing conditions
  - 20 knot crosswind landing capability
- Redundant Avionics
  - Redundant flight controls
  - Triple-Redundant flight processors
  - Redundant I/O & Power Bus
- Dual Automatic Take-off & Landing (ATLS)
  - Differential GPS
  - Back-up TALS (same as Shadow UAS system)
- Multiple hard points for weapons and external stores
  - (4 x on wings, 1 x center lower fuselage)
- Multiple Payload Bays
  - (2 x Forward Bays, 1 x Aft Bay)

## HELLFIRE Missiles



- Up to 4 HELLFIRE Missiles
- Current: HELLFIRE II UAS Variant Missiles
- Future: Transition to AGM-114R & JAGM

## Heavy Fuel Engine

- Diesel JP-8
- Reduced logistics due to common fuel
- 2.0 l Engine Provides:
  - Increased climb rates
  - Faster dash speeds
  - Increased fuel efficiency





# Gray Eagle RF Spectrum Requirements

System Component	Frequencies Used	Manufacturer	Quantity	Location	J/F-12 Number
H-764 Embedded GPS/INS (EGI)	S-Band 1575.42 MHz (L1) 1227.60 MHz (L2)	Honeywell / Trimble	1	Aircraft	J/F-12 7666
GS511 INS/GPS	S-Band 1575.42 MHz (L1) 1227.60 MHz (L2)	Athena	2	Aircraft	No DD 1494
AN/ARC-231 RT-1808 VHF/UHF Radio	VHF / UHF 30 MHz min 512 MHz max	Raytheon	1	Aircraft	J/F-12 7987
AN/APX-118(V) or 123 IFF Transponder	RX 920 to 1266MHz TX 1090 +- 0.1MHz	BAE Systems	1	Aircraft	J/F-12 07902/2 J/F-12 09691/2
TALS AS - Aircraft System	RX 34.78 to 35.08GHz TX 34.85 to 35.15GHz	Sierra Nevada Corporation (SNC)	1	Aircraft (Wing)	J/F-12 06982
TALS TS - Ground Unit	RX 34.85 to 35.15GHz TX 34.78 to 35.08GHz	Sierra Nevada Corporation (SNC)	2	Runway	J/F-12 06982



# Gray Eagle RF Spectrum Requirements

System Component	Frequencies Used	Manufacturer	Quantity	Location	J/F-12 Number
LOS Modem Assembly (MA) Data Link	14.40 to 14.83GHz 15.15 to 15.35GHz	L-3 Comm	2 2	Aircraft GDT	J/F-12 09711
SATCOM Modem Assembly (SMA) Data Link	RX 10.95 to 12.75GHz TX 13.75 to 14.5GHz	L-3 Comm	2 2	Aircraft GDT	J/F-12 9711
ME- 406 Emergency Locator Transponder	121.5 MHz Guard Freq 406.028 MHz Guard Freq	Artex	1	Aircraft	J/F-12 07477
Remote Link Module (RLM) With SecNet 11	S Band 2400-24835 MHz	Harris	3	The RLM links TALS and METS data with the GCS	J/F 12/7603



# Gray Eagle RF Spectrum Requirements

System Component	Frequencies Used	Manufacturer	Quantity	Location	J/F-12 Number
Electro-Optical / Infra-red / Laser Range Finder / Laser Designator (EO/IR/LRF/LD)	3um to 5um LRF 1.063um to 1.065um LD	Raytheon	1	Aircraft (Payload)	No J/F Required
LYNXII Synthetic Aperture Radar / Ground Moving Target Indicator (SAR / GMTI) or STARLite	4-inch Resolution: 15.2 to 18.2 GHz 6-inch resolution: 15.4 to 17.3 GHz	General Atomics Photonics	1	Aircraft (Payload)	J/F-12 7993 J/F-12 9722
War-fighter Information Network – Tactical (WIN-T) Communications Payload (WCP)	TBD	General Dynamics			TBD
AN/ARC-201D SINCGARS Radio	VHF 30 MHz min 88 MHz max	ITT Corporation	2	Aircraft	J/F-12 04967/6



# Gray Eagle RF Spectrum Requirements

System Component	Frequencies Used	Manufacturer	Quantity	Location	J/F-12 Number
AN/VRC-103 Receiver Transmitter RT-1796 ( P ) PRC-117F ( C ) (CCI)	VHF / UHF 30 MHz min 512 MHz max	Harris	2	OSGCS	J/F-12 07852
MIDS LVD(2) Link 16 Terminal	960 to 1215 MHz	ViaSat	1	OSGCS	J/F-12 4413/4
Blue Force Tracker (BFT) Satellite Transceiver	RX 1525 to 1559 MHz TX 1626.5 to 1660.5 MHz	Comtech Mobile DataCom	1	OSGCS	J/F12 7778
AN/PRC-148(V)1 Handheld	UHF / VHF 30 MHz min 512 Mhz max	THALES	2	OSGCS	J/F-12 07365/4
AN/PRC-152(V)1 Handheld	UHF / VHF 30 MHz min 512 Mhz max	Harris	2	UGCS	J/F-12/09317



# Ground Based Sense and Avoid

## System Description

### Mission

Ground Based Sense and Avoid (GBSAA) will provide Unmanned Aircraft Systems (UAS) with the capability to “see and avoid” other aircraft in the National Airspace System. GBSAA eliminates the need for visual observers and provides the ability to test and train at night.



### GBSAA System Description

#### Key Building Blocks

Commonality

Interoperability

Expandability

Safety/  
System  
Confidence

Early  
Capability  
(Now)

Baseline System  
(prototypes)

- GBSAA provides the necessary intelligence to the UAS to mitigate or provide an alternate means of compliance to the FAA “see and avoid” regulations (FAR Part 91.113)
- GBSAA system includes all available sensor data, correlation, fusion, communications, networks, logic, procedures and user interfaces

### History/Present

- First historic night flights in the NAS with a Sense and Avoid system occurred the week of 27 April 2011 at El Mirage, CA (ELMO) with Army GBSAA/Gray Eagle.
- Army has transitioned test activities from ELMO to Dugway Proving Ground to facilitate accelerated fielding schedules
  - Testing in restricted airspace (no FAA oversight necessary).
  - Testbed currently operates with existing radar systems (Range/ATC) with plans to install two 3D radar in Spring 2012
- As OSD Task Force GBSAA Lead, working with the tri-services to develop Common GBSAA requirements that support cost leveraging and mission needs for all

### Path Forward

- Army continues to serve as GBSAA lead developer, as designated by the OSD UAS Task Force, with the following goals:
  - Interoperability across services and platforms
  - Expeditious NAS access with easy capability growth
- GBSAA has received POM funding in FY 13-15 to support fielding to five Gray Eagle sites.
- Interoperability and Technology demos utilizing the DPG testbed currently planned for Summer 2012
  - Live/Virtual/Distributed tests demonstrating interoperability of system components to support Common GBSAA requirements development among the tri-services



# GBSAA Frequency Usage

- Radar is AN/TPQ-50(modified) but still fits into same 1494 specifications
- J/F-12 09652 1215-1390 MHz  
4M80Q3N & 2M77Q3N PEP: 2560 W
- Assignments at Dugway Proving Grounds- 2 Systems
- Working site locations and frequencies for all Gray Eagle fielding sites. Fort Hood, Stewart, Bragg, Campbell, & Riley
- Possible conflicts: fielding of AN/TPQ-50 to tactical units on same installation.



# Issues

- **IFF- Aims Certification Testing-seems to be constant changes in procedure to obtain assignment**
- **Last Minute requirements from Higher Headquarters**
- **Requestors not realizing lead times for assignment**
- **Contingency discussions overseas lead to “need now” reactions by leadership**
- **Obtaining “official” DD-1494 approval for devices**
- **Quantities of systems to operate simultaneously**
- **More than one PM working on same platform at the same location(ie: A-160)- confusing when AFMO gets multiple requests**



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# Unmanned Aircraft Systems Project Office

## Spectrum Management POCS

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# QUESTIONS